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Capital Cost of Pipeline Assets Used in Transporting Federal Royalty Oil: Critique of Treatment Under Current MMS Oil Valuation Rule

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Capital Cost of Pipeline Assets Used in Transporting Federal Royalty Oil: Critique of Treatment Under Current MMS Oil Valuation Rule

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Introduction

Under MMS's current royalty oil valuation rule[1], issued in 2000, the transportation allowance under non-arm's-length arrangements for movement of oil produced from Federal lands to a point of sale off the lease includes a capital cost element equal to the Standard & Poor's BBB industrial bond rate[2]. This is intended as an administratively simplified way to approximate the cost of capital faced by petroleum producing firms holding pipeline assets or investing in such assets. This paper investigates whether such a measure is a plausible approximation of such cost.

First, we present a conceptual framework for an appropriate measure of capital cost suitable for the rule. Such a measure must include both debt and equity cost, regardless of the specific financing earmarked for a specific asset. Second, using readily available current information from independent financial analysts, we conclude that the BBB bond rate itself appears far too low to cover the capital cost of the typical oil and gas firm represented by this data. This recent data suggests that an allowance of 1.6 to 1.8 times the BBB rate would be more appropriate for such a rule. Several variations on this analysis suggest that this key result, particularly the floor of 1.6 on an appropriate multiple, is insensitive to substantial variations in the choice of industry sample or the choice of time period.

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[1] 30 CFR 206.111(b), (i).

[2] As measured by the Standard and Poor's Corporate and Government Bond Yield Index, BBB Industrial, as published in the monthly *Standard and Poor's Bond Guide.* Appendix A presents the historical values of the monthly index through October 2002.

The Cost of Capital

The appropriate basis for measuring the allowance for transportation is the cost of capital to the firm. The cost of capital is the return that the market requires in order to attract funds to an investment. To survive in the long run, a firm must earn a return at least equal to its cost of capital. If a project cannot be expected to earn a return sufficient to cover the cost of capital, it should not be considered for investment. In the case of the MMS rule, setting the allowance at a level below that required to cover capital cost would provide an active and significant disincentive to development, especially in areas where pipeline investments are an essential component, such as the deep waters of the OCS.

Firms typically raise capital by issuing both debt and equity. The cost of issuing debt is typically lower than that of equity. Given this relationship, there is a natural question as to why firms should ever resort to equity finance. Both are used because a firm's access to the less expensive debt market (its "debt capacity") is limited by the fact that investors perceive excessive debt as risky. In the case of a bankruptcy, for instance, the firm is obligated to pay debt holders before equity holders. Consequently, there is less risk associated with debt than equity[3].

In the regulatory area, the cost of capital is typically measured by a firm's weighted average cost of raising investment funds. *This is the appropriate measure of the firm's cost of capital regardless of the specific financing used to fund any particular project.* That is, even if debt alone finances a specific project, the cost of debt finance alone fails to capture the cost of capital because the firm will have used up part of its debt capacity and will be forced to earmark higher cost equity capital to other projects.

Capital Structure

In the petroleum industry, there is a distinctive difference in the capital structure of the producers who fall into the refining industry (SIC291), and those who fall into the oil and gas extraction industry (SIC131)[4]. While some firms in SIC291 are in fact exclusively refiners, most are large integrated firms engaged in production as well. As a consequence, the petroleum producing industry is composed of two SIC's. SIC291 consists principally of integrated majors, while SIC131 consists of independent producers. Using a sample of firms developed independently by Ibbotson and Associates for a widely used reference on capital cost[5], we can estimate the capital structure of the two segments of the petroleum industry. About a third of the capital of independent producers, and about 11% of the capital of the integrated majors, currently consists of debt, as seen in Table 1.

Table 1. Debt share of total capital (%)

	SIC131	SIC291
Latest	33.92%	11.30%
Last 5 years	32.99%	8.40%

Source:
Ibbotson Associates, Cost of Capital 2002 Yearbook,
Monthly supplement with data through September 2002

[3] In fact, a study done in 2000 by the Energy Information Administration examined the characteristics of independent petroleum producers who survived the severe price collapse in the industry in 1998 and 1999. It found that a key difference between survivors and nonsurvivors was not their skill at finding and producing oil, as measured by their costs of reserve replacement, but rather the level of debt of the firm as it entered the period. Firms with higher than average debt ratios faced markedly lower odds of survival. US Department of Energy [2000].

[4] Both industries are engaged in oil and gas extraction, but the SIC classification is made on the basis of the primary activity. As a consequence, independent producers generally fall in SIC131, while integrated producers generally fall into SIC291, since their refining activity dominates.

[5] Ibbotson and Associates, *2002 Capital Cost Yearbook*, monthly supplement with data through September 2002.

Cost of Debt

The cost of debt to a firm depends on its credit-worthiness as determined by its bond rating (as determined by Standard and Poor's or Moody's), as well as on its marginal tax rate[6]. Specifically,

$$K_d^{post-tax} = K_d^{pre-tax}(1-t)$$

In both areas the two industry segments differ. First, there are very different levels of credit-worthiness between the large integrated firms and the independent producers, as reflected in the Standard & Poor's bond ratings shown in Table 2. Note that of the independent producers, 90 of the 99 firms in the sample are below BBB or not rated. On the other hand, 6 of the 11 integrated firms have bond ratings BBB or better.

Table 2. Debt Rating by SIC

	SIC131		SIC291	
S&P Debt Rating	Capital (billions of $)	No. of Firms	Capital (billions of $)	No. of Firms
AAA, AA, A	11.10	1	322.10	3
BBB	81.80	8	20.90	3
BB,B,CCC,CC,D	25.90	20	1.90	2
Not Rated	10.90	70	0.40	3
TOTAL	129.70	99	345.20	11

Source: Ibbotson Associates, Cost of Capital 2002 Yearbook, Monthly supplement with data through September 2002

This gives rise to substantially higher debt costs (pre-tax) faced by independents relative to the integrateds, and to debt costs faced by a substantial proportion of independents that alone (apart from equity cost) are unambiguously higher than the BBB rate offered by MMS. Second, integrated firms and independents face differing marginal tax rates, arising both from explicit statutory differences in tax provisions faced by the two segments and by dynamic features of the tax code which give rise to systematic differences in rates across all firms[7]. Generally, these rate differences favor the smaller independents, tending to offset part of the difference in pretax debt costs arising from credit ratings. As seen in Table 3, the marginal tax rates faced by independents was 22.7%, while the integrated firms faced a rate of 34.5%, nearly the full maximum statutory rate[8].

[6] The tax effect arises from the deductibility of interest expense. It should be noted that any published bond rate, such as the BBB index referenced in the MMS rule, is a pre-tax rate.

[7] In a static sense, the marginal tax rate is simply the statutory federal rate (35%) plus state and local rates between 1% and 12%, thought to average 5% (See KPMG, "Corporate Tax Rate Survey," January 2002). However, when one takes into account the dynamic effects of loss limitations, carryforward and carryback provisions, the Alternative Minimum Tax (AMT), etc., this is no longer the case. See Graham, J. [1996]. "Proxies for the Corporate Marginal Tax Rate," *Journal of Financial Economics*, Vol. 42, pp. 187-221.

[8] Private communication with Tara McDowell, Ibbotson Associates, November 21, 2002.

Table 3. Marginal Tax Rates (%)

SIC131	SIC291
22.72%	34.48%

Source: Ibbotson Associates data[9]

Cost of Equity

While there is no universally accepted method for measuring the cost of equity capital, there are a number of common methods used to estimate such costs. Despite some criticism, and the availability of alternative models, the most widely used model for estimating the cost of equity capital, particularly for large firms, is the Capital Asset Pricing Model (CAPM)[10]. The CAPM model is based on a view that the difference between the cost of equity and the rate of return offered by a risk-free security is a linear function of the systematic risk[11] associated with holding that firm's stock. Specifically,

$$K_e = R_f + \beta \text{ø} K_m - R_f \div$$

Where K_e is the cost of equity[12], R_f is the risk-free rate of return (usually a Treasury bill), K_m is the market rate of return (measured as the return on the whole market), and beta is a measure of systematic risk in the company stock.

For the Ibbotson sample, Table 4 presents the estimated cost of capital for the two segments of the oil and gas industry[13]. As seen in the Table, the cost of equity capital is between 2% and 3% higher for independent producers than for integrated majors.

Table 4. Cost of Equity Capital, Alternate Models

	SIC131	SIC291
CAPM	10.48%	8.31%
CAPM+Size Premium	11.20%	8.31%

Source: Ibbotson Associates, Cost of Capital 2002 Yearbook
Monthly supplement with data through September 2002

[9] Calculated by Ibbotson Associates as the market capitalization weighted sum of the marginal tax rates for each firm. Firm rates are provided by John Graham, using methods described in the Graham [1996,1998].
[10] Pratt, S. [2002]. *Cost of Capital: Estimation and Applications*, Second Edition,John Wiley and Sons, Hoboken, NJ, p.70.
[11] Systematic risk is the uncertainty of future returns to a particular company stock attributable to a systematic relationship of that stock value to that of the market as a whole.
[12] While not described here, for the purpose of keeping the exposition simple, in the actual Ibbotson calculation this is the cost of common stock equity. The numbers presented here actually include a separate category of capital for preferred stock, whose cost is the issuance of preferred dividends. However, the proportion of these shares is typically so low that such shares may be neglected.
[13] The size premium adjustment to the CAPM measure reflects a finding in many empirical studies that realized returns on many small companies have been substantially larger over a long time period than the original CAPM formulation would have predicted.

Weighted Average Capital Cost

These components, debt cost and capital cost, may be summed with the appropriate weights and tax rates to compute either a post-tax weighted average capital cost (WACC) for each industry segment in the Ibbotson sample, equal to

$$WACC^{post-tax} = \alpha K_d^{pretax} (1-t) + (1-\alpha) K_e$$

where alpha is the debt share of the firm's capital[14],

or a pre-tax WACC, equal to

$$WACC^{pre-tax} = \alpha K_d^{pretax} + (1-\alpha) K_e / (1-t)$$

Because of the dominance of equity in the capital structure of both segments, particularly the integrated firms, the lower debt cost has little influence on the computed WACC. As seen below in Table 5, the integrated firms are estimated to have a capital cost of 8.2%, only slightly below their cost of equity. Independents are estimated to have post tax capital costs between 2% to 3% higher than the integrated producers, though still only slightly below their own equity cost.

Table 5. Weighted Average Post-tax Cost of Capital

	SIC131	SIC291
CAPM	10.41%	8.16%
CAPM+Size Premium	10.91%	8.16%

Source: Ibbotson Associates, Cost of Capital 2002 Yearbook Monthly supplement with data through September 2002

Alternately, using the estimated federal marginal tax rates shown in Table 3, and neglecting any state income tax[15], this pre-tax WACC may be computed by dividing the entries in Table 5 by the quantity (1-t). Using the above data, this implies a pretax range of 13.5% to 14.1% for SIC31, and 12.5% for SIC291, as shown in Table 6. The higher pretax cost reflects the fact that the income tax raises the necessary hurdle rate of return required to cover the cost of any project.

Table 6. Weighted Average Pre-tax Cost of Capital

	SIC131	SIC291
CAPM	13.5%	12.5%
CAPM+Size Premium	14.1%	12.5%

Source: Calculated from Tables 3 and 5.

[15] This is a reasonable approximation given that most of the resources involved are located on federal offshore lands outside of state jurisdiction.

Implied Multiple of the BBB Rate

Compared to the BBB rate, these cost measures are substantially higher. The published Ibbotson measures are point estimates of WACC as of October 2002[16]. The closest corresponding published BBB rate, for October 2002, was 7.68%. As seen in Table 7, the implied multiple of BBB bond rates during this period was 1.62 for the integrated firms, and 1.76 to 1.84 for the independents.

Table 7. Ratio of Weighted Average Pre-tax Cost of Capital to BBB Bond Rate

	SIC131	SIC291
CAPM	1.76	1.62
CAPM+Size Premium	1.84	1.62

Source: calculated as ratio of pre-tax WACC (Table 6) to October 2002 BBB rate

It is easily shown that an alternate measure, using the lower post-tax WACC, is precisely equivalent, when compared to the BBB rate adjusted to a comparable post-tax basis. That is,

$$\frac{WACC^{post-tax}}{BBB^{post-tax}} = \frac{WACC^{pre-tax}\,(1-t)}{BBB^{pre-tax}\,(1-t)} = \frac{WACC^{pre-tax}}{BBB^{pre-tax}}$$

As a consequence, it is clear that current MMS treatment significantly understates the capital cost associated with transportation assets. One approach to correcting this problem would be to adjust the BBB bond rate upward by a multiple designed to correct this understatement. The current data, for example, would require a multiple from 1.76 to 1.84 for SIC131, and 1.62 for SIC291.

While somewhat imprecise, a simple multiple of the BBB bond rate avoids the burden of individually tailored cost allowances by substituting an administrative expedient that offers a reasonable prospect, on average, of covering the capital costs associated with pipeline assets. Establishing such a rule at too high a level would provide an unintended subsidy to such investment; establishing it at too low a level provides an unintended penalty to such investment. The data presented above suggest that the current rule falls far short of the capital cost required to leave the investment choice undistorted. As a consequence, the current rule provides an active and significant disincentive to development, especially in areas where pipeline investments are an essential component, such as the deep waters of the OCS.

Key Sensitivities

A key question: How robust is this conclusion is to the particular data and methodology selected? In particular, two key sensitivities warrant examination, namely, the sample of companies used in the analysis and the time period selected for the analysis.

[16] Communication with Mike Barad, Ibbotson Associates, November 21, 2002

Sample Selection

Because one constraint on the analysis was to rely as much as possible on readily available public data of known reliability, the samples of companies used by Ibbotson Associates in its most recent update to its 2002 *Capital Cost Yearbook* was taken to be representative of the SIC131 and SIC291 components of the petroleum producing industry. However, it was recognized that these samples were less than perfect representatives of the universe of petroleum producing firms building and operating pipeline assets. In particular, it seemed likely that the 11 firms in the Ibbotson SIC291 sample underrepresented the major integrated firms operating offshore, and that the 99 firms in the Ibbotson SIC131 sample overrepresented small independent producers with few if any pipeline assets. Because the larger firms typically have lower WACC than the smaller firms, this sample composition offered the potential for upwardly biasing the WACC and the estimated multiple of the BBB rate.

To test for such a systematic bias, API commissioned Ibbotson Associates to complete a study of capital cost for an alternate sample, namely the sample of 30 companies whose financial performance is routinely monitored by the Department of Energy as part of the Financial Reporting System (FRS). This set of FRS companies, shown in Appendix B, consists of the nation's largest energy producers, and has been a widely used barometer of US energy industry performance since the mid-70s. It contains all of the integrated oil companies as well as the largest independent producers and refiners. Consequently, it is likely to contain virtually all of the SIC291 firms with pipeline assets and all of the largest SIC131 firms with pipeline assets. By excluding all of the smaller independents unlikely to hold pipeline assets, it eliminates any potential upward bias resulting from their inclusion in the original Ibbotson sample. However, it neglects those middle size independents who may hold pipeline assets. Since these omitted firms are likely to have higher WACC than the FRS companies, the FRS sample has a clear and known bias toward lower than average industry WACC, so that *its estimated WACC may properly be interpreted as a floor to the industry WACC*. Table 8 presents a summary of the main results, along with a comparison with the Ibbotson yearbook sample.

Table 8. Comparison of FRS and Ibbotson Samples

	Ibbotson Sample, SIC131	Ibbotson Sample, SIC291	FRS
Tax Rate	0.23	0.34	0.30
Debt Share	0.34	0.11	0.17
Equity Share	0.66	0.89	0.83
Cost of Equity (pre-tax)	14.49	12.68	13.39
Cost of Equity (post-tax)	11.20	8.31	9.43
WACC (post-tax)	10.91	8.16	8.60
WACC (pre-tax)	14.12	12.45	12.22
BBB (post-tax)	5.94	5.03	5.41
BBB (pre-tax)	7.68	7.68	7.68
Ratio (WACC/BBB)	1.84	1.62	1.59

As seen in the table[17], the estimated post-tax WACC is 8.6%. Given the estimated 29.6% marginal tax rate, this implies a pre-tax WACC of 12.2% in October 2002, or 1.59 times the October 7.68% BBB bond rate, almost identical to the lower bound of the range developed on the basis of the original Ibbotson sample data. Given the known conservative bias of the FRS sample, these results provide a sound estimate of a lower bound on an appropriate multiple to be introduced as a part of any rulemaking. Consequently, they confirm the results presented based on the Ibbotson sample: *the multiple specified by a simple rule must be at least about 1.6 times the BBB rate to plausibly cover the capital cost associated with pipeline assets.*

Time Period

There is no reason to expect *a priori* that the estimate of the multiple should be stable over time or that the particular value for October 2002 should be a representative estimate for any other particular date. Rather, an empirical test is needed to assess whether either is true. Therefore, a second analysis was conducted, estimating the multiple at the beginning[18] of each year from 1997 to 2002, and comparing these estimates to that obtained for the most recent data, October 2002. This was a period of enormous change in both the structure and the market environment of the industry, as it consolidated in the face of extraordinary variations in revenue and spending associated with extraordinary price volatility. Tables 9 and 10 present the results of this examination for each of the two industry sectors.

Table 9. Behavior of Estimated Multiple for SIC131, 1997-2002

	1997	1998	1999	2000	2001	2002	October 2002
Tax Rate	0.350	0.239	0.264	0.065	0.156	0.212	0.227
Debt Share	0.280	0.376	0.301	0.238	0.209	0.278	0.339
Equity Share	0.720	0.624	0.699	0.762	0.791	0.722	0.661
Cost of Equity (pre-tax)	22.85	14.94	19.14	15.52	15.09	15.64	14.49
Cost of Equity (post-tax)	14.85	11.37	14.08	14.52	12.74	12.32	11.20
WACC (post-tax)	12.28	10.09	11.85	12.59	12.09	11.95	10.91
WACC (pre-tax)	18.47	13.26	16.11	13.46	14.32	15.17	14.12
BBB (post-tax)	5.56	5.43	5.58	8.10	6.98	6.55	5.94
BBB (pre-tax)	7.84	7.13	7.58	8.66	8.27	8.31	7.68
Ratio (WACC/BBB)	2.21	1.86	2.13	1.55	1.73	1.83	1.84

[17] The complete Ibbotson study of the FRS companies is presented as Appendix D to this report.

[18] Ideally, this would have been January of each year, insofar as the MMS rule specifies the use of a January BBB rate. However, Ibbotson only publishes the Yearbook with data through March, along with quarterly supplements at the end of June, September and December. The March publication was chosen for the analysis on the strong recommendation by Ibbotson that its relative completeness and consistency made it the most appropriate choice for a multi-year comparison. In particular, it appeared that the alternative (end-December) resulted in severe underreporting of debt in the petroleum industry, distorting the capital structure toward equity. Ibbotson's recommendation is attached to this report as Appendix E. Tables 9 and 10 calculate the multiple on the basis of a comparison of the March WACC with the March BBB rate. However, there is no significant difference if the January BBB rate is used as an alternative.

Table 10. Behavior of Estimated Multiple for SIC291, 1997-2002

	1997	1998	1999	2000	2001	2002	October 2002
Tax Rate	0.350	0.315	0.319	0.348	0.345	0.347	0.345
Debt Share	0.128	0.104	0.104	0.109	0.064	0.026	0.113
Equity Share	0.873	0.896	0.896	0.892	0.936	0.974	0.887
Cost of Equity (pre-tax)	18.40	16.23	16.31	14.78	15.97	14.13	12.68
Cost of Equity (post-tax)	11.96	11.11	11.11	9.64	10.47	9.23	8.31
WACC (post-tax)	11.03	10.46	10.46	9.16	10.09	9.15	8.16
WACC (pre-tax)	16.97	15.28	15.35	14.04	15.40	14.01	12.45
BBB (post-tax)	5.43	4.88	5.16	5.65	5.42	5.43	5.03
BBB (pre-tax)	7.84	7.13	7.58	8.66	8.27	8.31	7.68
Ratio (WACC/BBB)	2.04	2.14	2.03	1.62	1.86	1.69	1.62

As shown in Tables 9 and 10, this analysis suggests that estimates based on current data (the most recent Ibbotson data in October 2002) appear conservative relative to similar measures calculated for the last six years. The average estimated multiple for the six years from 1997 to 2002 is virtually identical for both SIC131 and SIC291, at about 1.9. The estimates based on October 2002 data are 2% less than the 5 year average for SIC131, and 15% below the 5 year average for SIC 291.

Summary

This study suggests strongly that the current allowance of the BBB bond rate does not offer a reasonable prospect of covering the capital cost associated with pipeline assets involved in the transportation of Federal royalty crude. The principal findings of the study are that:

1. Analysis of current data show that the estimated multiple required to cover capital cost associated with these pipelines would be between 1.6 and 1.8.
2. An independent analysis conducted by Ibbotson Associates for the FRS companies, a widely used sample of firms more representative of the universe of firms holding such pipeline assets, confirmed that it would require a multiple of *at least* 1.6 times the BBB rate to plausibly cover capital costs.
3. Examination of the pattern of costs from 1997 to 2002 reveals that in recent history the average multiple of the BBB rate required to cover capital cost was about 1.9.

As a consequence, the results of the study indicate an unambiguous failure of the current rule to cover capital costs. Such a rule impedes oil resource development in areas where pipeline transportation to market represents a significant portion of investment cost.

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APPENDIX A

Growth Rates of Standard and Poor's BBB Bond Index

Table A-1. Standard & Poor's Corporate and Government Bond Yield Index, BBB Industrial

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1996	6.99	7.1	7.7	7.95	8.08	8.21	8.11	7.87	8.07	7.72	7.39	7.5
1997	7.73	7.54	7.84	7.99	7.03	7.73	7.45	7.49	7.38	7.21	7.19	7.19
1998	7.18	7.09	7.13	7.13	7.12	6.99	7.05	7.03	6.96	7.16	7.46	7.26
1999	7.36	7.46	7.58	7.43	7.69	8.08	8.04	8.38	8.5	8.64	8.44	8.64
2000	8.81	8.58	8.66	8.75	9.31	8.95	8.83	8.71	8.84	8.7	8.63	8.44
2001	8.29	8.26	8.27	8.44	8.53	8.34	8.36	8.16	8.18	8.13	8.14	8.41
2002	8.26	8.13	8.31	8.19	8.11	7.69	7.98	7.71	7.41	7.68	#N/A	#N/A

Source: *Standard and Poor's Bond Guide* , various issues

APPENDIX B

Oil and Gas Firms Included in Ibbotson Sample, Capital Cost Yearbook

Table B-1. Ibbotson Sample, SIC 291

Ticker	Company Name
3AIPN	AMER INTL PETROLEUM CORP
3ARSD	ARABIAN AMERICAN DEVELOPMENT
CVX	CHEVRONTEXACO CORP
XOM	EXXON MOBIL CORP
FTO	FRONTIER OIL CORP
HOC	HOLLY CORP
MRO	MARATHON OIL CORP
MUR	MURPHY OIL CORP
SUN	SUNOCO INC
TSO	TESORO PETROLEUM CORP
VLO	VALERO ENERGY CORP

Table B-2. Ibbotson Sample, SIC 131

Ticker	Company Name	Ticker	Company Name
TTEN	3TEC ENERGY CORP	ISRL	ISRAMCO INC
ABP	ABRAXAS PETROLEUM CORP/NV	KCS	KCS ENERGY INC
3ALTX	ALTEX INDUSTRIES INC	KEST	KESTREL ENERGY INC
APC	ANADARKO PETROLEUM CORP	KP	KEY PRODUCTION CO INC
APA	APACHE CORP	MPET	MAGELLAN PETROLEUM CORP
3ASPN	ASPEN EXPLORATION CORP	MHR	MAGNUM HUNTER RESOURCES INC
BRN	BARNWELL INDUSTRIES	MLRC	MALLON RESOURCES CORP
3BSIC	BASIC EARTH SCIENCE SYS INC	TMR	MERIDIAN RESOURCE CORP
BRY	BERRY PETROLEUM -CL A	MSSN	MISSION RESOURCES CORP
BDCO	BLUE DOLPHIN ENERGY	3NEGI	NATIONAL ENERGY GROUP
3BREY	BLUE RIDGE ENERGY INC	NFX	NEWFIELD EXPLORATION CO
BEXP	BRIGHAM EXPLORATION CO	NBL	NOBLE ENERGY INC
TBI	BROWN (TOM) INC	NCEB	NORTH COAST ENERGY INC
BR	BURLINGTON RESOURCES INC	NEV	NUEVO ENERGY CO
COG	CABOT OIL & GAS CORP	3OAKR	OAKRIDGE ENERGY INC
CPE	CALLON PETROLEUM CO/DE	OXY	OCCIDENTAL PETROLEUM CORP
CRZO	CARRIZO OIL & GAS INC	OEI	OCEAN ENERGY INC
CECX	CASTLE ENERGY CORP	PANRA	PANHANDLE RLTY CO -CL A
CXY	CHENIERE ENERGY INC	PLLL	PARALLEL PETROLEUM CORP
CHK	CHESAPEAKE ENERGY CORP	PEX	PETROCORP INC
CWEI	CLAYTON WILLIAMS ENERGY INC	3PTLD	PETROL INDUSTRIES INC
CRK	COMSTOCK RESOURCES INC	3PTRO	PETROMINERALS CORP
MCF	CONTANGO OIL & GAS CO INC	PQUE	PETROQUEST ENERGY INC
CRED	CREDO PETROLEUM CORP	PXD	PIONEER NATURAL RESOURCES CO
DPTR	DELTA PETROLEUM CORP	PLX	PLAINS RESOURCES INC
DNR	DENBURY RESOURCES INC	PPP	POGO PRODUCING CO
DVN	DEVON ENERGY CORP	PENG	PRIMA ENERGY CORP
DHULZ	DORCHESTER HUGOTON -LP	PNRG	PRIMEENERGY CORP
DBLE	DOUBLE EAGLE PETROLEUM CO	3PYOL	PYRAMID OIL CO
EPEX	EDGE PETROLEUM CORP	RRC	RANGE RESOURCES CORP
EEX	EEX CORP	REM	REMINGTON OIL&GAS CP -CL B
EOG	EOG RESOURCES INC	3RPRS	REPUBLIC RESOURCES INC
EQTY	EQUITY OIL CO	MARY	ST MARY LAND & EXPLOR CO
EVG	EVERGREEN RESOURCES	SGY	STONE ENERGY CORP
EXCO	EXCO RESOURCES INC	3STFA	STRATFORD AMERICAN CORP
TXCO	EXPLORATION CO	SFY	SWIFT ENERGY CO
3FORL	FORELAND CORP	TGC	TENGASCO INC
3FPXA	FORTUNE NATURAL RESOURCES CP	3TVOC	TEXAS VANGUARD OIL CO
GEOI	GEORESOURCES INC	TPY	TIPPERARY CORP
GDP	GOODRICH PETROLEUM CORP	TRGL	TOREADOR RESOURCES CORP
3GPOR	GULFPORT ENERGY CORP	3TRIL	TRI VALLEY CORP
3GULF	GULFWEST ENERGY INC	UXP	UNITED STATES EXPLORATION

APPENDIX C

Oil and Gas Firms Included in US Department of Energy Financial Reporting System (FRS)

Table C-1. The FRS Companies

Amerada Hess Corporation	Lyondell-CITGO Refining, L.P.
Anadarko Petroleum Corporation	Marathon Oil Company
Apache Corporation	Motiva Enterprises, L.L.C.
BP America, Inc.	Occidental Petroleum Corporation
Burlington Resources, Inc.	Phillips Petroleum Company
ChevronTexaco Corporation	Premcor, Inc.
CITGO Petroleum Corporation	Shell Oil Company
Conoco, Inc.	Sunoco, Inc.
Devon Energy Corporation	Tesoro Petroleum Corporation
Dominion Resources, Inc.	Tosco Corporation
El Paso Corporation	Total Fina Elf Holdings USA, Inc.
EOG Resources, Inc.	Ultramar Diamond Shamrock Corporation
Equilon Enterprises, L.L.C.	Unocal Corporation
Exxon Mobil Corporation	Valero Energy Corporation
Kerr-McGee Corporation	The Williams Companies, Inc.

Source:
US Department of Energy, Energy Information Administration

Note: Several companies were not included, because they are not publicly traded, while others merged with other companies in the group. The set of current FRS companies included in the Ibbotson analysis is shown in Exhibit 5 of the attached study.